
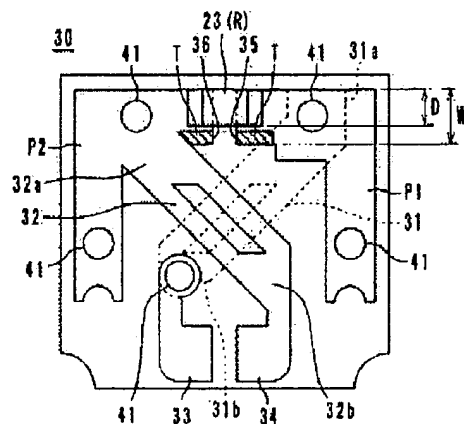


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 Title of invention: TWO-PORT ISOLATOR AND ITS MANUFACTURING METHOD AND COMMUNICATION APPARATUS

Abstract: PROBLEM TO BE SOLVED: To provide a two-port isolator capable of adjusting the central frequency of isolation and to provide its manufacturing method and a communication apparatus.SOLUTION: A central electrode board 30 is formed with a first central electrode 31 in its one side and with a second central electrode 32, an input port electrode P1, an output port electrode P2, and earth electrodes 33, 34 in its other side. Further, a rectangular electrode 35 for connecting a first resistor is provided in an extending manner from the input port electrode P1 in order to connect electrically an end 31a of the first central electrode 31 and a resistor 23. In a similar fashion, a second rectangular electrode 36 for connecting a second resistor is provided in an extending manner from the output port electrode P2 in order to connect electrically an end 32a of the second central electrode 32 and the resistor 23. These electrodes 35, 36 for connecting the first and the second electrodes include a trimming portion T, respectively.COPYRIGHT: (C)2004,JP O&NCIPI



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[ABSTRACT]

[PROBLEM TO BE SOLVED]

Two ports type isolator, production method of two ports type isolator which can adjust a center frequency of *aisoresyon* and communications equipment are provided.

[SOLUTION]

As for central electrode board 30, the first central electrode 31 is formed by one aspect, the second central electrode 32 and input port electrode P1 and output port electrode P2 and ground electrode 33,34 are formed by the other aspect. Even more particularly, The first rectangular resistance connection business electrode 35 does *enzai* from input port electrode P1 to be connected between end 31a of the first central electrode 31 and resistance 23 electrically. In a like manner, The second rectangular resistance connection business electrode 36 does *enzai* from output port electrode P2 to be connected between end 32a of the second central electrode 32 and resistance 23 electrically. Electrode 35,36 for the first these and the second resistance connection comprise trimming part T respectively.

[SELECTED FIGURE]

FIG. 2

[WHAT IS CLAIMED IS]

[Claim 1]

The ferrite which a direct current magnetic field is applied to by permanent magnification and said permanent magnification and said ferrite are approached, and is disposed, the first one end is connected to I/O port electrically, another end intersects in the first central electrode connected to a ground electrically and the first above central electrode and an electrical isolation state, and above ferrite is approached, and is disposed, the second one end is connected to I/O port electrically, the second resistance connection business electrode connected between the first resistance connection business electrode connected between the second parallel capacitor connected between the first parallel capacitor connected between the resistance that another end is connected to between above one end of the second central electrode connected to a ground electrically and the first central electrode and above one end of the second central electrode electrically and the first above I/O port and grounds electrically and the second above I/O port and grounds electrically and above one end and above resistance of the first central electrode electrically and above one end and above resistance of the second central electrode electrically is comprised, it is two ports type isolator including, at a minimum, an electrode of either comprising trimming region of the first above resistance connection business electrode and the second above resistance connection business electrode.

[Claim 2]

Two ports type isolator; according to claim 1 wherein; Electrode width of an electrode for the first said resistance connection and an electrode for the second said resistance connection is bigger than width of above resistance in a resistance joint.

[Claim 3]

Claim 1 or two ports type isolator as claimed in claim 2; comprising: The first input and output terminal and the second input and output terminal, The first series capacitor which is connected to the first said I/O port between the first said input and output terminals electrically, The second series capacitor which is connected to the second said I/O port between the second said input and output terminals electrically.

[Claim 4]

Two ports type isolator as claimed in any one of one or more claim claim 3; comprising: A case surrounding above resistance in said permanent magnification, said ferrite, said the first and the second resistance connection business electrode, above the first and the second central electrode equal thing is comprised, it is a trimming work business hole to an above case.

[Claim 5]

Two ports type isolator as claimed in any one of one or more claim claim 4; wherein; Said the first and the second central electrode are installed in the front and back side of a central electrode board respectively, and trimming region of said the first and the second resistance connection business electrode is installed in the same aspect of an above central electrode board.

[Claim 6]

Two ports type isolator as claimed in any one of one or more claim claim 4; wherein; Said the first and the second central electrode are arranged in the surface of said ferrite or the inside.

[Claim 7]

Two ports type isolator as claimed in any one of one or more claim claim 4; wherein; Said resistance and said the first and the second parallel capacitor and said the first and laminated substrate which the second resistance connection business electrode piles up plural dielectric layers and electrode layers, and was composed are installed in.

[Claim 8]

Production method of two ports type isolator; wherein; Predetermined length is lasted for, and it is parallel, and said trimming part of two ports type isolator as claimed in any one of one or more claim claim 7 is trimmed, a center frequency of *aisoresyon* is adjusted in a desired value.

[Claim 9]

Communication device 100; comprising: Two ports type isolator as claimed in any one of one or more claim claim 7.

[DETAILED DESCRIPTION OF THE INVENTION]

[0001]

[TECHNICAL FIELD OF THE INVENTION]

The present invention relates to two ports type isolator and more particularly relates to two ports type isolator, production method of two ports type isolator employed in a, microwave zone and communications equipment.

[0002]

[PRIOR ART]

In general terms, An isolator passes signals only in a transmission direction, a function to prevent transmission to a reverse course is provided, is employed by a car telephone, transmitter region of mobile communication machinery such as a cellular phone.

[0003]

By way of example only, As this kind of isolator, two ports type isolator as claimed in patent document 1 is known. After having disposed the use capacitor that these two ports type isolator matched ferrite and parallel in the inside of a case, is produced by that resistance crosses an implemented central electrode board or permanent magnet, and it can be accompanied.

[0004]

The first and the second central electrode are formed in lower surface on a central electrode board, the first central electrode and the second central electrode intersect in an electrical isolation state each other. A capacitor for parallel adjustment is connected to the first and the second central electrode in parallel electrically respectively. Even more particularly, Resistance is connected between one end of the first central electrode and one end of the second central electrode electrically, another end of the first central electrode and another end of the second central electrode are grounded respectively.

[0005]

[patent document 1]

Japanese Patent Laid-Open No. 2001-185912 bulletin

[0006]

[PROBLEM TO BE SOLVED BY THE INVENTION]

Now, In general terms, as for the first and the second central electrode formed by a central electrode board, relative position relation of the electrode width and electrode thickness, the first central electrode and the second central electrode or an intersection angle of the first central electrode and the second central electrode varies. Because of this, An insertion loss of two ports type isolator, a reflection loss and a center frequency of *aisoresyon* vary , for the case the worst, there are a defective article and a problem that it is without a desired characteristic being provided.

[0007]

Here, If unevenness of an insertion loss and a reflection loss seems to be the following, and it is done, it can dissolve. At first, Before assembling an isolator, the first and dimensions of the second central electrode of a central electrode board are measured. Next, A parallel adjustment business capacitor of the capacitance that was suitable for a combination with the central electrode board based on this measurement data is chosen. In this way, Unevenness of an insertion loss and a reflection loss is controlled by putting capacitor for parallel adjustment having appropriate capacitance together every central electrode board, a desired characteristic can be got.

[0008]

However, The unevenness of a center frequency of *aisoresyon* was not able to dissolve in a patent document 1-2 port type isolator. Because, A center frequency of *aisoresyon* is because adjustment by a capacitance change of a parallel adjustment business capacitor is impossible mainly so that it is determined by means of relative position relation and an

intersection angle of the first central electrode and the second central electrode. Because of this, Before assembling an isolator, only a central electrode board having a center frequency of desired *aisoresyon* is sorted, two ports type isolator of a desired characteristic was got by disposing of the central electrode board which became bad.

[0009]

Thus, An object of the invention is to provide two ports type isolator, production method of two ports type isolator which can adjust a center frequency of *aisoresyon* and communications equipment.

[0010]

[MEANS TO SOLVE THE PROBLEM AND OPERATION]

Two ports type isolator (a) concerning the present invention approaches ferrite (c) which a direct current magnetic field is applied to by a permanent magnet (b) and an above permanent magnet and above ferrite, and is disposed to achieve the object, the first one end is connected to I/O port electrically, another end intersects in the first central electrode (d) connected to a ground electrically and the first above central electrode and an electrical isolation state, and the ferrite is approached, and is disposed, the second one end is connected to I/O port electrically, the second resistance connection business electrode connected between the first resistance connection business electrode (i) connected between the second parallel capacitor (h) connected between the first parallel capacitor (g) connected between resistance (f) that another end is connected to between one end of the second central electrode (e) connected to a ground electrically and the first central electrode and one end of the second central electrode electrically and the first above I/O port and grounds electrically and the second above I/O port and grounds electrically and one end of the first central electrode and the resistance electrically and one end of the second central electrode and the resistance electrically is comprised (j), of the first above resistance connection business electrode and the second resistance connection business electrode, it is characterized in in, at a minimum, an electrode of either comprising trimming region.

[0011]

The first and the second central electrode are installed in the front and back side of a central electrode board respectively, and the first and trimming region of the second resistance connection business electrode are installed in the same aspect of a central electrode board. Or the first and the second central electrode are arranged in the surface of ferrite or the inside.

[0012]

A center frequency of *aisoresyon* moves to the low frequency side by trimming region of electrode and the second resistance connection business electrode for the first resistance connection is trimmed by the above-mentioned constitution, and doing electrode width narrowly. It is desirable for electrode width of trimming part to be bigger than width of resistance. Because, Resistance and the part which are not piled up are secured in a direction of electrode width, predetermined length is lasted for, and it is parallel, and it can be trimmed, the reason is because trimming work is easy to become do.

[0013]

In addition, When an insertion loss grows big input and output impedance is high, and not to be able to take adjustment, the first series capacitor is connected between the first

I/O port and the first input and output terminals electrically, and the second series capacitor should be connected between the second I/O port and the second input and output terminals electrically. By this, Adjustment take, and an insertion loss is improved.

[0014]

In addition, Two ports type isolator concerning the present invention is characterized by that a trimming work business hole was established to a case surrounding resistance in permanent magnification, ferrite, the first and the second resistance connection business electrode, the first and the second central electrode equal thing. Through a hole for trimming work, trimming region of the first resistance connection business electrode and the second resistance connection business electrode can be trimmed after having assembled two ports type isolator by the above-mentioned constitution.

[0015]

In addition, It is characterized by that resistance and the laminated substrate which the first and the second parallel capacitor and the first and the second resistance connection business electrode pile up plural dielectric layers and electrode layers, and was composed are installed in. By this, Connection points by a solder of resistance, the first parallel capacitor, the second parallel capacitor, electrode for the first resistance connection and the second resistance connection business electrode mutual interval decrease, connection reliability improves, and a back can plan small size of an isolator low.

[0016]

In addition, An *aisoresyon* characteristic improves communication device 100 concerning the present invention by a thing comprising two ports type isolator, and reduction of a production cost is enabled.

[0017]

[MODE FOR CARRYING OUT THE INVENTION]

As follows, An embodiment of two ports type isolator concerning the present invention, production method of two ports type isolator and communications equipment is described when taken with the drawing.

[0018]

[the first embodiment, FIG. 1-FIG. 5]

FIG. 1 is an exploded perspective view of intensive fixed number type isolator 1 of two ports. As for two ports type isolator 1, it is from outline, permanent magnification 9 and ferrite 20 and tip capacitor 24 functioning as capacitor 21,22 for parallel adjustment and resistance 23 and a ground conductor (it does not make function as a capacitor) and central electrode board 30 and product made in resin terminal case 3 and metal upper part case 4 and metal bottom case 8.

[0019]

Metal bottom case 8 comprises sidewalls 8b and bottom 8a of right and left. On earth bottom case 8 made by this metal is molded with terminal case 3 made by resin by insert mold method. From opposed a pair of sides of bottom 8a of metal bottom case 8, two ground connections 16 does *enzai* respectively. In addition, It is *heimenshikanekeijo*, and metal upper part case 4 comprises upper part 4a and sidewalls 4b of right and left.

[0020]

So that metal upper part case 4 and metal bottom case 8 forms a magnetic circuit, the

sheet which is based on high materials of magnetic permeability of iron, with a die, it is knocked down, after having done bending, copper plating is put for the surface, even more particularly, silver plating is put, and it is got.

[0021]

Terminal case 3 made by resin comprises bottom 3a and two side 3b. Rectangular aperture 3c is formed in central part of this bottom 3a. At the position that is next to aperture 3c, reentrant 3d to accommodate resistance 23 is formed. Bottom 8a of metal bottom case 8 is exposed to aperture 3c. To terminal case 3 made by resin, input terminal 14 and output terminal 15 can leave insert mold. As for input terminal 14 and output terminal 15, one end is exposed to outer side surface of terminal case 3 made by resin respectively, another end is exposed to bottom 3a of product made in resin terminal case 3, and is done with input drawer electrode 14a, output drawer electrode 15a.

[0022]

Permanent magnification 9 comprises abbreviation rectangular solid shape. This permanent magnification 9 may incorporate the thing which can leave *chakuji* beforehand in isolator 1, and it is incorporated in isolator 1 in the state that is not made *chakuji*, it is resembled afterwards, and *chakuji* may be done. In addition, Ferrite 20 comprises abbreviation rectangular solid shape.

[0023]

As for central electrode board 30, the first central electrode 31 is formed by the surface, the second central electrode 32 and input port electrode P1 and output port electrode P2 and ground electrode 33,34 are formed by back surface. In FIG. 2, watched central electrode board 30 is shown by a back side. As for central electrode board 30, it is from phenolic resin, epoxy resins, resin such as polyimide resin and paper, matrix such as a glass cross. In addition, A patterning can leave central electrode 31,32 and port electrode P1, P2 by methods to etch after a printing method and plating by conductive material (for example, copper).

[0024]

It is connected to input port electrode P1 which one end 31a goes through through-holes 41, and is formed by back surface of the first central electrode 31 formed by the surface electrically. It is connected to ground electrode 33 which other end 31b goes through through-holes 41, and is formed by back surface of the first central electrode 31 electrically. On the other hand, One end 32a of the second central electrode 32 formed by back surface is connected to output port electrode P2 electrically, other end 32b is connected to ground electrode 34 electrically. The second central electrode 32 intersects the first central electrode 31 at generally 90 degrees.

[0025]

Even more particularly, The first rectangular resistance connection business electrode 35 does *enzai* from input port electrode P1 to be connected between end 31a of the first central electrode 31 and resistance 23 electrically. In a like manner, The second rectangular resistance connection business electrode 36 does *enzai* from output port electrode P2 to be connected between end 32a of the second central electrode 32 and resistance 23 electrically. Electrode 35,36 for the first these and the second resistance connection comprise trimming part T (regions displayed with a slanted line in FIG. 2) respectively. It is constant, and electrode width W of electrode 35,36 for resistance connection is set in a resistance joint more greatly than width D of resistance 23 by

length. By this, Resistance 23 and a part (trimming part T) which are not piled up are secured in a direction of electrode width W. Thus, Trimming part T can be trimmed after a solder is attached to central electrode board 30, and having done resistance 23, trimming work is easy to become do.

[0026]

Resistance 23 forms a terminal electrode with thick film print to an ends of a board, a resistance body is arranged in the meantime. Before resistance 23 is usual, and trimming trimming part T, a solder stick to electrode 35,36 for resistance connection of central electrode board 30, and is implemented, but, central electrode board 30 be accompanied by a solder after trimming, and it may be implemented.

[0027]

An example of a trimming work method is explained below. By way of example only, An *aisoresyon* characteristic of charge account implemented central electrode board 30 that grazed resistance 23 with a test apparatus is measured. Quantity of trimming is decided from this measurement result. Next, It is parallel, and, by means of laser and sand blaster or *ryuta*, trimming part T is sharpened in length of resistance connection business electrode 35,36 by predetermined length. By this, A center frequency of *aisoresyon* can be matched with a desired value (a value equal to a center frequency of an insertion loss to be concrete). As a result, Electrode width unevenness of central electrode 31,32, a relative position gap of central electrode 31,32 or unevenness of a center frequency of *aisoresyon* by intersection angle unevenness of central electrode 31,32 can be reduced.

[0028]

The single plate capacitor which arranges capacitor electrodes on top and bottom side is used for capacitor 21,22 for parallel adjustment. Tip capacitor 24 merely uses the external electrode 24a, 24b as a connection conductor to connect central electrode 31,32 and metal bottom case 8 to electrically not a thing using a function as a capacitor.

[0029]

The above-mentioned component does as follows, and it is assembled. Capacitor 21,22 for parallel adjustment and tip capacitor 24 and ferrite 20 is accommodated in aperture 3c of terminal case 3 made by resin. Then, External electrode 24a of tip capacitor 24, 24b and lower part side (the cold side) capacitor electrodes of capacitor 21,22 for parallel adjustment are grounded by bottom 8a of metal bottom case 8 which is exposed to aperture 3c of product made in resin terminal case 3 respectively.

[0030]

Next, Charge account central electrode board 30 that grazed resistance 23 which did is accommodated in product made in resin terminal case 3. Then, In *heimenshi* of central electrode board 30, ferrite 20 is disposed at the position where the second central electrode 32 intersects the first central electrode 31. Resistance 23 is accommodated by reentrant 3d. Input port electrode P1 is connected to top surface side capacitor electrodes and input drawer electrode 14a of capacitor 21 for parallel adjustment. Output port electrode P2 is connected to top surface side capacitor electrodes and output drawer electrode 15a of capacitor 22 for parallel adjustment. Ground electrode 33,34 are connected to external electrode 24a of tip capacitor 24, 24b respectively.

[0031]

Even more particularly, Metal upper part case 4 is put on from the top. Permanent magnification 9 is disposed in bottom of upper part 4a of metal upper part case 4. By this,

Permanent magnification 9 applies a direct current magnetic field to ferrite 20 disposed underneath of central electrode board 30. Metal upper part case 4 is connected to metal bottom case 8 electrically, and a metal case is done, a magnetic circuit is composed with permanent magnet 9 and ferrite 20, it functions as a yoke.

[0032]

In electrical connect of a capacitor 21,22, tip capacitor 24, drawer electrode 14a for parallel adjustment, 15a, metal upper part case 4 and metal bottom case 8 mutual interval, a method such as solder ruff low is used. In this way, Two ports type isolator 1 is provided.

[0033]

Circuit diagram, FIG. 4 to explain a theory of isolator 1 are figures of equivalent circuit of isolator 1 FIG. 3. In FIG. 3, an arrow is a direction of a high frequency magnetic field under central electrode 31,32.

[0034]

When transmission of a signal of an order direction is thought about, high frequency signals input to the first central electrode 31 from input terminal 14 as shown in a thing (A) of FIG. 3 rotate 90 degrees in ferrite 20. It spreads, and, as for the second high frequency signals which rotated, it is output central electrode 32 from output terminal 15. When potential of ground connection 16 is assumed 0, from a direction of a high frequency magnetic field, it is in +V +V, electrical current potential of output terminal 15 potential of input terminal 14. Thus, Because both ends of resistance 23 do not have a potential difference, high frequency signals begun from input terminal 14 are just output from output terminal 15 without high frequency signals flowing to resistance 23.

[0035]

On the other hand, When incidence of a signal of a direction is thought about reversely, high frequency signals input to the second central electrode 32 from output terminal 15 as shown in a thing (B) of FIG. 3 rotate 90 degrees in ferrite 20. It spreads, and, as for the first high frequency signals which rotated, should be output central electrode 31 from input terminal 14, but, a direction of a high frequency magnetic field becomes a thing (A) of FIG. 3 to reverse then. When potential of ground connection 16 is done with 0 in a direction of a high frequency magnetic field being a direction reverse to a thing (A) of FIG. 3, it is in -V electrical current potential of input terminal 14. From a direction of a high frequency magnetic field, as for the potential of input terminal 14, potential difference +2V produce -V, potential of output terminal 15 at the +V neighbor, both ends of resistance 23. Because of this, High frequency signals spread by resistance 23, is converted into heat by means of resistance 23 (is done electrical power consumption), high frequency signals are not output from input terminal 14 ideally. In addition, Because, resistance 23, there are a little reactance ingredients, an *aisoresyon* characteristic becomes a wide band.

[0036]

However, actually L1 ? L2 is usually had a relation of with inductance L1 of the first central electrode 31 and inductance L2 of the second central electrode 32 so that electrode width of central electrode 31,32 varies, and relative position of central electrode 31,32 slips off, and an intersection angle of central electrode 31,32 varies.

[0037]

Even more particularly, Like an equivalent circuit shown in FIG. 4, there is occurring

remaining inductance $Ls1$ in input terminal 14 and input port electrode P1 and capacitor electrodes oneself of parallel adjustment business capacitor 21 between input terminal 14 and capacitor 21 for parallel adjustment. Between input terminal 14 and the first central electrode 31, there is occurring remaining inductance $Ls2$ in input terminal 14 and input port electrode P1 oneself. Between the first central electrode 31 and ground connection 16, there is occurring remaining inductance $Ls3$ in ground electrode 33 and external electrode 24a of tip capacitor 24 and eight metal bottom case own.

[0038]

And, Between output terminal 15 and capacitor 22 for parallel adjustment, there is occurring remaining inductance $Ls4$ in output terminal 15 and output port electrode P2 and capacitor electrodes oneself of parallel adjustment business capacitor 22. Between output terminal 15 and the second central electrode 32, there is occurring remaining inductance $Ls5$ in output terminal 15 and output port electrode P2 oneself. Between the second central electrode 32 and ground connection 16, there is occurring remaining inductance $Ls6$ in ground electrode 34 and external electrode 24b of tip capacitor 24 and eight metal bottom case own.

[0039]

And, The sum ($Ls4+Ls5+Ls6$) of remaining inductance of output terminal 15 side usually ($Ls1+Ls2+Ls3$) has a relation of ? ($Ls4+Ls5+Ls6$) with the sum ($Ls1+Ls2+Ls3$) of remaining inductance of these input terminal 14 side, too.

[0040]

Because of this, Ideal movement explained in FIG. 3 is deviated from, potential difference +2V do not occur at desired frequency at both ends of resistance 23. Thus, Respectively predetermined length is lasted for, and trimming region T of electrode 35,36 for the first and the second resistance connection is sharpened so that potential difference +2V occur at both ends of resistance 23, it makes thin electrode width. By this, Inductance $L3$ of electrode 35,36 for the first and the second resistance connection, $L4$ are adjusted in the numerical value that was suitable respectively, a grand total ($L2+L4+Ls4+Ls5+Ls6$) of inductance of grand total ($L1+L3+Ls1+Ls2+Ls3$) and output terminal 15 side of inductance of input terminal 14 side becomes generally equal. As a result, A center frequency of *aisoresyon* can be matched with a desired value, unevenness of a center frequency of *aisoresyon* by electrode width unevenness and a relative position gap and intersection angle unevenness of central electrode 31,32 can be controlled.

[0041]

It is explained by means of numerical value to be concrete. FIG. 5 is an insertion loss of electrode width W and isolator 1 of electrode 35,36 for resistance connection, *aisoresyon* and a graph to show the result that evaluated relation with an each of center frequency of an input and output reflection loss in. Then, Width D is 0.3mm, the head to resistance 23, but, 0.6mm, external electrode 24a, width of 24b used a chip component of 0.12mm. Resistance value R of resistance 23 made cope with central electrode 31 (32) and parallel resonance impedance with capacitor 21 (22) for parallel adjustment, and an insertion loss set in 91 value ? which improved most. The distance between things of electrode 35 for resistance connection and 36 set to 0.2mm. In addition, The length of trimming (it is sharpened) in trimming part T assumed electrode 35,36 for resistance connection 0.35mm.

[0042]

And, When isolator 1 wants to be operated at 2520MHz, electrode width W of electrode 35,36 for resistance connection is designed to 0.6mm, conventionally, to be big beforehand, and it is than 2520MHz a center frequency of *aisoresyon* by all means. Conventionally, electrode width W of electrode 35,36 for resistance connection was designed to about 0.3mm. By this, Electrode 35,36 for resistance connection comprise trimming part T respectively. Next, A center frequency of *aisoresyon* can be done to comb, 2520MHz of a desired center frequency low by this trimming part T is sharpened, and doing electrode width W of electrode 35,36 for resistance connection narrowly.

[0043]

[the second embodiment, figure 6 and figure 7]

input and output impedance is high only with capacitor 21,22 for parallel adjustment, and, in isolator 1 of the first embodiment, the case that adjustment cannot be taken as produces. In this case As shown in figure 6 and figure 7, capacitor 25,26 for two series adjustment are connected to isolator 1 of the first embodiment.

[0044]

The single plate capacitor which arranges capacitor electrodes on top and bottom side is used for capacitor 25,26 for series adjustment. Capacitor 25 for series adjustment is serially-connected between input port electrode P1 and input drawer electrode 14a. Capacitor 26 for series adjustment is serially-connected between output port electrode P2 and output drawer electrode 15a.

[0045]

Two ports type isolator 1A comprising the above-mentioned constitution can easily take impedance matching by what capacitance of parallel adjustment business capacitor 21,22 and series adjustment business capacitor 25,26 is changed into, an insertion loss can be improved.

[0046]

[the third embodiment, FIG. 8]

but the third embodiment describes the two ports type isolator which can trim trimming region of an electrode for resistance connection after assembling completion.

[0047]

FIG. 8 is the figure which watched two ports type isolator 1B after assembling completion from the bottom side. When trimming work business hole 45,46 were established in bottom 8a of metal bottom case 8 of two ports type isolator 1 of the first embodiment, this isolator 1B is similar. Trimming part T of electrode 35,36 for resistance connection exposes through hole 45,46 for trimming work.

[0048]

Thus, An *aisoresyon* characteristic of isolator 1B after assembling completion is measured, trimming region T is sharpened through trimming work business hole 45,46 when *aisoresyon* came off from a standard, it can be put together to a center frequency of desired *aisoresyon*. As a result, A bad number can be reduced, a production cost can be held down.

[0049]

[the fourth embodiment, FIG. 9-FIG. 11]

FIG. 9 is an exploded perspective view to show an embodiment according to a thing of two ports type isolator concerning the present invention. Two ports type isolator 51 consists of outline, permanent magnification 59 and ferrite 60 and laminated substrate 70 and metal case 54. Metal case 54 is *heimenshikanekeijo*, and four sidewalls 54b and upper part 54a are provided.

[0050]

Ferrite 60 is abbreviation rectangular solid shape, and generally 90 degrees intersect in an electrical isolation state each other, and the first central electrode 61 and the second central electrode 62 is arranged on inside. One end of the first central electrode 61 is connected to input side hot electrode 63 electrically, another end is connected to ground side cold electrode (not shown) electrically. One end of the second central electrode 62 is connected to output side hot electrode 64 electrically, another end is connected to ground side cold electrode (not shown) electrically.

[0051]

It is the multilayered board which laminated substrate 70 piles up plural dielectric layers and capacitor electrode layers, and was composed. It is not illustrated, but, in the inside of this laminated substrate 70, the first embodiment and a parallel adjustment business capacitor and series adjustment business capacitor explained in the second embodiment are had built-in. Land 71,72,73,74 for ferrite implementation are installed in the top surface of laminated substrate 70. Land 71-74 for ferrite implementation connect these to input and output side hot electrode 63,64 of ferrite 60 and a ground side cold electrode respectively. Here, Land 71,72 for ferrite implementation are equivalent to input port electrode P1 and output port electrode P2 respectively.

[0052]

In two opposed end surfaces of laminated substrate 70, 84, input terminal output terminal 85 and four ground connections 86 is installed in a half cylindrical wall side. These terminals 84-86 do *enzai* in lower surface of laminated substrate 70 as shown in FIG. 10. And, In lower surface of laminated substrate 70, two sets of opposed ground connections 86 is connected with electrode 87,88 electrically respectively. But, Ground connection 86 does not have to be always connected with electrode 87,88 electrically, and it may make four ground connections 86 be independent. On the other hand, *enzai* is done so that electrode 75,76 for rectangular resistance connection face from input terminal 84 and output terminal 85 respectively respectively. Electrode 75,76 for resistance connection comprise trimming part T (regions displayed with a slanted line in FIG. 10) respectively. Input terminal 84 and output terminal 85 goes through a beer hall and an electrode established inside of laminated substrate 70 respectively, and it is connected to ferrite implementation business land 71,72 electrically. A beer hall and electrodes made inside of laminated substrate 70 are gone through, and ground connection 86 is connected to ferrite implementation business land 73,74 electrically likewise.

[0053]

Even more particularly, It is formed by a method such as screen process so that print resistance 80 extends to electrode 75,76 for two resistance connection.

[0054]

The above-mentioned component does as follows, and it is assembled. Permanent magnification 59 and ferrite 60 is carried in the top surface of laminated substrate 70, and it is implemented. Even more particularly, Metal case 54 is put on from the top. In this

way, Two ports type isolator 51 is provided.

[0055]

This isolator 51 has built-in to laminated substrate 70 without employing an individual chip component for capacitor and resistance for capacitor and series adjustment for parallel adjustment, and a film becomes, and it is formed in the surface of laminated substrate 70. Thus, Solder joule connection points decrease, connection reliability improves, and isolator 51 can be made a small size low back.

[0056]

In addition, But this isolator 51 sharpens trimming region T after assembling completion in trimming part T of electrode 75,76 for resistance connection being exposed to bottom side, it can be put together to a center frequency of desired *aisoresyon*. In addition, Laminated substrate 70 adjusts to specifications of an isolator, and it can be transformed in various ways, for example, like laminated substrate 70A shown in FIG. 11, ground connection 86 may be established in the end face that is different from the end face where input and output terminal 84,85 were established.

[0057]

[the fifth embodiment, FIG. 12]

, in this the fifth embodiment, a cellular phone is made an example, and detailed description of the preferred embodiment of communication device 100 is explained.

[0058]

FIG. 12 is electrical circuits block diagram of a RF part of cellular phone 120. In FIG. 12, voltage controlled oscillator (VCO), 139 are country business band pass filter receive side mixer, 138 receive side interval between shelves business band pass filter, 137 receive side low noise amplifier, 136 transmission of a message side mixer, 135 business band pass filter between transmission of a message side steps, 134 transmission of a message side power amplifier, 133 isolator, 132 duplexer, 131 antenna elements, 123 122.

[0059]

Here, For isolator 131, isolator 1,1A of the first the fourth-embodiment, 1B,51 can be employed. An *aisoresyon* characteristic improves by implementing these isolator 1,1A, 1B,51, and a cheap cellular phone of a production cost can be realized.

[0060]

[other embodiments]

the present invention can be changed in various kinds of constitution in a range of subject matter of the present invention rather than a thing limited to the embodiment. By way of example only, It was assumed that terminal case 3 made by resin and metal bottom case 8 formed in insert mold, and it was described, but, not a thing limited to this, product made in resin terminal case 3 and metal bottom case 8 is formed separately, it may have been put together. In addition, In the first the fourth-embodiment, output terminal was explained for 15,85 with input terminal 14,84, but, not a thing limited to this, output terminal may be done to 14,84 with input terminal 15,85.

[0061]

Even more particularly, In the embodiment, the isolator which formed central electrode 31,32 in the front and back side of central electrode board 30 and the isolator which

formed central electrode 61,62 in the inside of ferrite 60 were described, but, it is not the thing which always limits to this. By way of example only, It may be the isolator which a patterning made a central electrode by methods to etch after a printing method and plating by conductive material on ferrite.

[0062]

Or it may be an isolator with the use of metal materials to become from a common ground electrode of two central electrodes and the central electrode. A ground electrode of this metal materials is disposed to cover lower surface of ferrite. On the other hand, It is bent to wrap ferrite, and two central electrodes are machined, it makes an insulation-related seat intervene, and is disposed to intersect at mutual *ga* abbreviation 90 degrees in the top surface of ferrite. A central electrode comprises port part P1, P2 in each one end side, it is connected to top surface side capacitor electrodes of a parallel adjustment business capacitor with a solder electrically.

[0063]

Or it may be the isolator which ferrite is bound to intersect at mutual *ga* abbreviation 90 degrees, and turned two linear central electrodes.

[0064]

[EFFECT OF THE INVENTION]

Center frequencies of *aisoresyon* can be put together in a desired value according to the present invention by the above-mentioned explanation to be clear by trimming region of electrode and the second resistance connection business electrode for the first resistance connection is trimmed, and doing electrode width narrowly. As a result, The first and unevenness of a center frequency of *aisoresyon* by electrode width unevenness and a relative position gap and intersection angle unevenness of the second central electrode can be controlled.

[BRIEF DESCRIPTION OF DRAWINGS]

[FIG. 1]

It is an exploded perspective view to show the first embodiment of two ports type isolator concerning the present invention.

[FIG. 2]

It is the plane view that watched a central electrode board shown in FIG. 1 from a back side.

[FIG. 3]

It is a circuit diagram to explain a theory of two ports type isolator shown in FIG. 1.

[FIG. 4]

It is a figure of equivalent circuit of two ports type isolator shown in FIG. 1.

[FIG. 5]

An insertion loss of electrode width *W* and an isolator of an electrode for resistance connection, *aisoresyon* and a graph to show the result that evaluated relation with an each of center frequency of an input and output reflection loss in.

[FIG. 6]

It is an exploded perspective view to show the second embodiment of two ports type isolator concerning the present invention.

[FIG. 7]

It is a figure of equivalent circuit of two ports type isolator shown in FIG. 6.

[FIG. 8]

It is a bottom plan view showing the third embodiment of two ports type isolator concerning the present invention.

[FIG. 9]

It is an exploded perspective view to show the fourth embodiment of two ports type isolator concerning the present invention.

[FIG. 10]

It is the plane view that watched a laminated substrate shown in FIG. 9 from a back side.

[FIG. 11]

It is the plane view that considered transformation example of a laminated substrate shown in FIG. 9 from a back side.

[FIG. 12]

It is a block diagram showing one embodiment of communication device 100 concerning the present invention.

[DENOTATION OF REFERENCE NUMERALS]

9,59 14,15,84,85 20,60 21,22 23,80 25,26 30 31,32,61,62 35,36,75,76 45,46 70 120 case
... permanent magnet ... input and output terminal ... ferrite ... parallel adjustment
business capacitor ... resistance ... series adjustment business capacitor ... central
electrode board ... central electrode ... resistance connection business electrode ...
trimming work business hole ... laminated substrate ... cellular phone P1 ... input port
electrode P2 ... output port electrode T ... trimming region made by 1,1A, 4,8,54 two 1B
,51 ... ports type isolator ... metal
